

DIVERSION

(Feet)
Code 362

Natural Resources Conservation Service
Conservation Practice Standard

I. Definition

A channel constructed across the slope generally with a supporting ridge on the lower side.

II. Purposes

This practice may be applied as part of a resource management system to support one or more of the following purposes:

- To break up concentrations of water on long slopes, on undulating land surfaces, and on land that is generally considered too flat or irregular for terracing.
- To divert water away from farmsteads, agricultural waste systems, and other improvements.
- To increase or decrease the drainage area above ponds.
- To protect terrace systems by diverting water from the top terrace where topography, land use, or land ownership prevents terracing the land above.
- To intercept surface and shallow subsurface flow.
- To reduce damages from upland runoff.
- To reduce erosion and runoff on urban or developing areas and at construction or mining sites.
- To divert water away from active gullies or critically eroding areas.
- To supplement water management on conservation cropping or strip cropping systems.

III. Conditions Where Practice Applies

This practice is applicable to all cropland and other land uses where surface runoff water control and or management is needed. It also applies where soils and topography are such that the diversion can be constructed and a suitable stable outlet is available or can be provided.

IV. Federal, State, and Local Laws

Users of this standard should be aware of potentially applicable federal, state and local laws, rules,

regulations or permit requirements governing diversions. This standard does not contain the text of federal, state, or local laws.

V. Criteria

The following criteria apply to all purposes.

A. Capacity

Diversions used as temporary measures, with an expected life span of less than 2 years, shall have a minimum capacity to convey the peak discharge from a 2-year frequency, 24-hour duration storm.

Diversions that protect agricultural land shall have a minimum capacity to convey the peak discharge from a 10-year frequency, 24-hour duration storm. Freeboard shall not be less than 0.1 feet.

Diversions designed to protect areas such as urban areas, buildings, roads, or are components of animal waste management systems shall have a minimum capacity to convey the peak discharge from a storm frequency consistent with the hazard involved but not less than a 25-year frequency, 24-hour duration storm. Freeboard shall be not less than 0.3 feet.

Peak discharges for all storms will be determined by the method outlined in NRCS National Engineering Handbook (NEH) Part 650, Engineering Field Handbook (EFH) Chapter 2 or Technical Release 55 (TR-55).

The capacity of vegetative diversions shall be based on vegetative retardance A, B, or C. The retardance used shall be in accordance with NRCS EFH Chapter 7, Exhibit 7-2. The retardance used shall consider the types of grasses to be seeded and the type of management anticipated. In urban or farmstead areas, D retardance may be

appropriate for the evaluation of capacity if frequent mowing and maintenance are assured.

B. Cross Section

The channel may be parabolic, V-shaped, or trapezoidal. The diversion shall be designed to have stable side slopes, but no slope shall be steeper than two horizontal to one vertical (2:1).

The ridge shall have a minimum top width of 4 feet at the design depth. Design depth is the channel storm flow depth plus freeboard, where required.

The ridge top width may be 3 feet at the design depth for diversions with less than 10 acres of drainage area above cropland, pastureland, or woodland and for diversions used as temporary measures.

The top of the constructed ridge at any point shall not be lower than the design depth plus the overfill for settlement. The minimum additional fill for settlement shall be 10 percent of the fill height.

The design depth at culvert crossings shall be the culvert headwater depth for the design storm plus freeboard.

C. Grade and Velocity

Channel grades may be uniform or variable. Channel velocity shall not exceed that considered non-erosive for the soil, as shown in Table 1, and the planned vegetation.

Channel velocities for permanently vegetated channels shall be obtained by using the procedures, “n” values, and recommendations in the NRCS EFH Chapter 7, or Agricultural Research Service (ARS) Agricultural Handbook 667, Stability Design of Grass-Lined Open Channels.

Maximum velocities for diversions with linings shall be as specified in the NRCS Field Office Technical Guide (FOTG), Section IV, Standard 468, Lined Waterway, or as specified by the manufacturer for commercially available lining products.

Maximum velocities for diversions with bare soil channels shall be as shown in Table 2. A Manning’s “n” value of 0.03 or less shall be used for determining the velocity in bare soil channels.

Table 1
Vegetated Diversion Velocity

Diversion Slope range (%)	Permissible velocity ¹	
	Erosion resistant soils ² (ft/sec)	Easily eroded soils ³ (ft/sec)
0-5	7	5
5.1-10	6	4
Over 10	5	3

¹ Use velocities exceeding 5 ft/sec only where good cover and proper maintenance can be obtained.

² Cohesive (clayey) fine-grain soils and coarse-grain soils with cohesive fines with a plasticity index of 10 to 40 (CL, CH, SC, and GC).

³ Soils that do not meet the requirements for erosion-resistant soils.

Table 2
Bare Soil Channel Diversion Velocity

Soil Texture ¹	Permissible Velocity (ft./sec.)
Sands, silts, and loams (SW, SP, ML, SM, SM-SC, CL-ML)	1.5
Silty clay loams, and sandy clay loams (SC, CL) PI<10	2.0
Silts, Clays (MH, CL, CH) PI≥10	2.5

¹ General description and Unified Soil Classification System designation. PI is plasticity index.

D. Location

The outlet conditions, topography, land use, cultural operations, cultural resources, and soil type shall determine the location of the diversion.

E. Protection Against Sedimentation

Diversions shall not be used below high sediment producing areas unless a practice or combination of practices are installed to prevent damaging accumulations of sediment in the channel. This may include practices such as land treatment erosion control

practices, cultural or tillage practices, vegetated filter strips, or structural measures. Install practices in conjunction with or before the diversion construction.

If movement of sediment into the channel is anticipated, the design shall include extra capacity for sediment or periodic removal as outlined in the operation and maintenance plan.

F. Crossings

Crossings shall be in accordance with the criteria contained in NRCS FOTG Standard 578, Stream Crossing.

G. Outlets

Each diversion must have a safe and stable outlet with adequate capacity. The outlet may be a grassed waterway, a lined waterway, a vegetated or paved area, a grade stabilization structure, an underground outlet, a stable watercourse, a sediment basin, or a combination of these practices. The outlet must convey runoff to a point where outflow will not cause damage. Vegetative outlets shall be installed and established before diversion construction to insure establishment of vegetative cover in the outlet channel.

The release rate of an underground outlet, when combined with storage, shall be such that the design storm runoff will not overtop the diversion ridge.

The design depth of the water surface in the diversion shall not be lower than the design elevation of the water surface in the outlet at their junction when both are operating at design flow.

H. Vegetative Establishment

Diversions shall be vegetated according to NRCS FOTG Standard 342, Critical Area Planting, as soon as practicable after construction.

Seedbed preparation, time of seeding, species, seeding rate, stabilizing crop, mulching, or mechanical means of stabilizing, fertilizer, and lime requirements shall be specified.

I. Lining

If the soils or climatic conditions preclude the use of vegetation for erosion protection, non-vegetative linings such as gravel, rock riprap, cellular block,

or other approved manufactured lining systems may be used.

VI. Considerations

Additional recommendations relating to design that may enhance the use of, or avoid problems with, this practice but are not required to ensure its basic conservation functions are as follows.

- A. A diversion in a cultivated field should be aligned and spaced from other structures or practices to permit use of modern farming equipment. The side slope lengths should be sized to fit equipment widths when cropped.
- B. At non-cropland sites, consider planting native vegetation in areas disturbed due to construction.
- C. Maximize any wetland functions and values with the diversion design. Minimize adverse effects to existing functions and values. Diversion of upland water to prevent entry into a wetland may convert a wetland by changing the hydrology.
- D. Any construction activities should minimize disturbance to wildlife habitat. Opportunities should be explored to restore and improve wildlife habitat, including habitat for threatened, endangered, and other species of concern.
- E. On landforms where archeological sites are likely to occur, use techniques to maximize identification of such sites prior to planning, design, and construction.

VII. Plans and Specifications

Plans and specification for installing diversions shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose.

VIII. Operation and Maintenance

An operation and maintenance plan shall be prepared for use by the client. The plan shall include specific instructions for maintaining diversion capacity, storage, ridge height, and outlets.

The plan shall include the following items and others as appropriate.

- A. Provide periodic inspections, especially immediately following significant storms.
- B. Promptly repair or replace damaged components of the diversion as necessary.
- C. Maintain diversion capacity, ridge height, and outlet elevations especially if high sediment yielding areas are in the drainage area above the diversion. Establish necessary clean-out requirements.
- D. Each inlet for underground outlets must be kept clean and sediment buildup redistributed so that the inlet is at the lowest point. Inlets damaged by farm machinery must be replaced or repaired immediately.
- E. Redistribute sediment as necessary to maintain the capacity of the diversion.
- F. Vegetation shall be maintained and trees and brush controlled by hand, chemical and/or mechanical means. To protect nesting wildlife, delay mowing until July 15.
- G. Keep machinery away from steep sloped ridges. Keep equipment operators informed of all potential hazards.

IX. References

USDA, Natural Resources Conservation Service, National Engineering Handbook, Part 650, Engineering Field Handbook.

USDA, Natural Resources Conservation Service, Technical Release 55, Urban Hydrology for Small Watershed.

USDA, Wisconsin Field Office Technical Guide, Section IV (Conservation Practice Standards and Specifications).

USDA, Agricultural Research Service, Agricultural Handbook 667, Stability of Grass-Lined Open Channels.